Question Number	Answer	Mark
***1 (a)**	**Take into account quality of written communication when awarding the following points.** 1. idea of calibration for volume ; 2. idea of calibration for time ; 3. description of how to calculate tidal volume (from trace) / eq ; 4. idea that one peak = one breath ; 5. reference to breathing rate is number of peaks per minute ; 6. idea of standardised group of males and females e.g. same age, non-smokers ; 7. idea that traces taken at rest ; 8. reference to replicates ; 9. description of how to calculate the mean from the trace ;	**(6)**

Question Number	Answer	Mark
1 (b)(i)	1. PEF increases (from 15) to when they are in their 30s and then decreases ; 2. reaches a peak at age {30 to 34} for women / eq ; 3. reaches a peak at age {36 to 39} for men / eq ; 4. idea that PEF falls below value at 15 (later on in life) ; 5. manipulation of figures to illustrate the points above ;	**(4)**

Question Number	Answer	Mark
1 (b)(ii)	weakening of muscles / loss of elasticity of lungs ;	**(1)**

Question Number	Answer	Mark
1 (b)(iii)	1. he is more than 30% below / must be less than 400 dm^3 min^{-1}/ he is {37 to 39 %} below / eq ; 2. there re his asthma is not under control ;	**(2)**

Question Number	Answer	Mark
1 (b)(iv)	height ;	**(1)**

Question Number	Answer	Mark
2 (a)QWC	(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. *(gas exchange)* occurs through the {*cell membrane* / *phospholipid bilayer}* ; 2. idea that the *membrane* is thin ; 3. *oxygen* enters cell (from water) / eq ; 4. *carbon dioxide* leaves cell (into water) / eq ; 5. {O_2 / *oxygen* / CO_2 / *carbon dioxide*} are {small / *non-polar*} (*molecules)* ; 6. reference to *diffusion* ; 7. {reference to / description} (suitable) *concentration gradient* ; 8. reference to *large surface area (to volume ratio)* ;	**(4)**

Question Number	Answer	Mark
2 (b)	1. reference to diffusion (in the cytoplasm) ; 2. through the cytoplasm / description of part of cytoplasm / eq ; 3. down a concentration gradient (in the cytoplasm) / eq ;	**(2)**

Question Number	Correct Answer	Mark
3(a)	1. carbon dioxide produced in respiration / eq ; 2. affects {volume / pressure} of gas / eq ; 3. allows measurement of oxygen used / eq ;	**max (2)**

Question Number	Correct Answer	Mark
3(b)(i)	Two marks for correct answer 0.8 (mm min^{-1}) ;; if incorrect allow one mark for correct working 1. 48 ; OR 1. 12 ; 2. ÷ 60 to give answer ; OR 2. ÷ 15 to give answer	**(2)**

Question Number	Correct Answer	Mark
3(b)(ii)	1. no oxygen available/no oxygen uptake ; 2. reference to anaerobic respiration ; 3. carbon dioxide produced is absorbed / eq ; 4. no (net) change of {volume / pressure} of gas ;	**max (2)**

Question Number	Correct Answer	Mark
3(b)(iii)	1. {mass / eq} of organism may differ ; 2. use same mass / express results per unit mass / eq ; 3. temperature changes / eq ; 4. control temperature using a water bath / eq ; 5. pressure may affect volume of gas / eq ; 6. use of control with no organisms, at the same time / eq ;	**max (4)**

Question Number	Answer	Additional Guidance	Mark
4(a)	1. idea of large surface area to volume ratio or that it is thin (body) ; 2. idea that this helps diffusion e.g. short diffusion distance, faster diffusion ;	1. IGNORE flat, small unqualified, thin membrane, thin skin etc NOT cell wall 2. IGNORE gas exchange NOT osmosis	(2)

Question Number	Answer	Additional Guidance	Mark
4(b)(i)	1. solubility of oxygen decreases as temperature increases / eq ; 2. credit correct manipulation of figures ;	1. ACCEPT converse, negative correlation 2. units not required but if given then they must be correct e.g. 8.2 mg dm^{-3} difference in solubility between 0 and 40 ^{o}C, solubility halved between 5 ^{o}C and 40 ^{o}C	(2)

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	1. idea that there is quite a lot of dissolved oxygen in the water at this temperature ; 2. idea of oxygen concentration gradient (between water and flatworm's cells) ; 3. idea of enzyme activity being temperature-dependent ; 4. idea that water below 15^{o}C would be too cold for {enzymes / metabolism / eq} to work effectively ; 5. idea that it is a balance between oxygen availability and {enzyme activity / kinetic effects /eq} ;	IGNORE there is most oxygen available 1. ACCEPT sufficient O_2, not enough O_2 at higher temps. 2. Re to diffusion or gas exchange alone, not sufficient for the mark 3. CCEPT e.g. 15^{o}C is optimum for their enzymes NB: This is for linking enzymes and temperature, Mp4 is a development of Mp3 stating something specific. 4. IGNO ref to effects above 15^{o}C	(3)
Question Number	Answer	Additional Guidance	Mark

Question Number	Answer	Additional Guidance	Mark
4(c)	1. heart needed to {pump / move / eq} blood (around the body) ; 2. reference to mass flow ; 3. idea that many animals have a small surface area to volume ratio ; 4. idea that a circulatory system is needed to overcome limitations of diffusion / eq ; 5. credit correctly named molecule transported (in blood) ; 6. idea that many animals have a high metabolic rate ;	4. ACCEPT idea that diffusion is not sufficient 5. oxygenated blood not enough by itself ACCEPT any appropriate molecule in the blood ACCEPT idea of thermoregulation e.g. heat	(4)